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NMR with pulsed magnetic field gradient in studies of physicochemical processes in molecular systems

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Abstract

The principles of the NMR method with pulsed magnetic field gradient and the use of this method in studies of the structure and the dynamics of complex molecular systems are considered. Data on self-diffusion of flexible-chain polymers in solution are generalized based on the universal molecular-weight dependence of self-diffusion coefficients of macromolecules. The special features of the formation of three-dimensional macromolecular networks are analyzed for the example of gel formation. The potentialities of NMR with pulsed magnetic field gradient as a tool for studying stratification in polymer-solvent systems and constructing complete phase diagrams are demonstrated and exemplified by the results obtained for the polyoxybutadienediol-water, polyoxybutadienediol-hexane, polypropyleneglycol-water, and polystyrene-cyclohexane systems. Data on self-diffusion in porous media and polymeric membranes are analyzed. Boundary and permeability effects on self-diffusion of small molecules in porous systems are discussed. The most important factors determining ionic and molecular transport in ion-exchange membranes are analyzed. It is shown that there exists an interrelation between the structure of transport channels and the character of diffusing substance-polymer matrix interactions on the one hand and translations of ions and molecules on the other. The most important principles of selective electrochemical mass transfer in ion-exchange membranes are formulated.